COMPARISON OF PRODUCTION PERFORMANCE BETWEEN TWO BROILER BREEDER STRAINS IN NORTHEN PART OF BANLADESH

A Thesis
By

MUHAMMAD ILIAS
Registration No: 1405093
Session: 2014-15

MASTER OF SCIENCE
IN
POULTRY SCIENCE

DEPARTMENT OF DAIRY AND POULTRY SCIENCE
HAJEE MOHAMMAD DANESH SCIENCE AND TECHNOLOGY UNIVERSITY, DINAJPUR

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Submitted to the department of Dairy and Poultry Science, Hajee Mohammad Danesh Science & Technology University, Dinajpur

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DEDICATED
TO MY
BELOVED PARENTS

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The Author

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ABSTRACT

The present study was conducted on Broiler Strains (Cobb-500 & Arbor Acres) maintained atKazi farms located in Northen part of Bangladesh to compare the egg production performance, Mortality rate, Hatchability and feed (kg) per hatching egg from 25 to 64 weeks of age.The highest egg production of Cobb-500 were observed in 30 to 34 weeks of age (79.76 ± 0.893) and the lowest in 60 to 64 weeks of age (46.76 ±0.724). The highest egg production of Arbor Acres were observed in 35 to 39 weeks of age (75.12 ± 0.257) and the lowest in 60 to 64 weeks of age (47.88 ±0.86). There were no significant difference ($p<0.05$) in egg production between Cobb-500 and Arbor Acres strain (79.76 ± 0.893 and 74.24 ± 0.851) at 30-34 weeks of age and (74.92 ± 0.257and 75.12 ± 0.25) at 35-39 weeks of age but significant difference between two strains at the age of 25-29, 40-44, 45-49, 50-54, 55-59, and 60-64 weeks.The highest mortality of Cobb-500 were observed in 60 to 64 weeks of age (0.9600 ± 0.07543) and the lowest in 40 to 44 weeks of age (0.2900 ± 0.02470). The highest mortality of Arbor Acres were observed in 60 to 64 weeks of age (1.2260 ± 0.05519) and the lowest in 40 to 44 weeks of age (0.4800 ± 0.0446). There were no significant difference ($p<0.05$) in mortality between Cobb-500 and Arbor Acres strain at different weeks of age .The highest hatchability of Cobb-500 were observed in 35 to 39 weeks of age (92.0680 ± 0.11249) and lowest in 60 to 64 weeks of age (75.7640 ± 0.34243). The highest hatchability of Arbor Acres were observed in 40 to 44 weeks of age (89.0140 ± 0.20061) and the lowest in 60 to 64 weeks of age (73.4300 ± 0.35355). There is no significant difference ($p<0.05$) in hatchability between Cobb-500 and Arbor Acres strain (92.4060 ± .10260 and 88.1880 ± .42407) at 35 to 39 weeks of age and (92.0680 ± .11249 and 89.0140 ± .20061) at 40 to 44 weeks of age but significant difference was found between two strains at the age of 25-29, 30-34, 45-49, 50-54, 55-59 and 60-64 weeks. There were no significant difference ($p<0.05$) in feed requirement of per hatching egg between Cobb-500 and Arbor Acres strain at age of 30-34, 40-44 and 45-49 weeks but significant differences were found among other weeks. In conclusion Cobb-500 strain was appeared to be most economic to rear than Arbor Acres in response their performance record.

Keywords: Egg production, mortality, hatchability, feed per gram hatching egg.

CHAPTER I

INTRODUCTION

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Poultry keeping in the past was a sideline occupation. In some communities, the fowl is still used as in the past, as a means of knowing the time. Today, poultry keeping has developed to the level of commercial enterprise involving thousands of birds. Large poultry units have replaced small one's while more efficient strains and breeds of birds, balanced feeds, intensive housing and better poultry equipment have come into used. The poultry industry has become a diverse industry with a variety of business interests such as egg production, meat production, hatchery and poultry equipment business. However, the decision to start a poultry farm depend on whether or not the farmer is aware that poultry production is one of the most promising sources of additional income, protein intake and quick returns from investments. Poultry can be established with a minimum cost and as a side project. Moreover, they can feed for themselves on free range without much care.

The products produced from poultry provide an acceptable form of animal protein to most of the people throughout the world. Boiler breeder production is one of the profitable production activities than broiler and layer production. A broiler breeder could generate Rs. 786±49.8 as net profit giving 106±7.34% return over the invested capital (Farooq *et al*., 2001) as compared to broiler (Rs. 7/broiler per flock; Asghar *et al*., 2000) and layer farming (Rs. 38.26±6.66 per layer; Farooq *et al*., 2003). However, breeder farming is not that simple and easy, as it requires special rearing environment and huge investment than any other poultry production activity. Thus, it's beyond the approach of every farmer. Farmers involved in broiler breeder production should therefore keep a vigilant eye on management and better care and know the important production traits to make it more\profitable. A broiler breeder hen usually starts egg production at the age of 23-24 weeks and produces around 183 hatch able eggs out of 199 total hens housed eggs produced in 65 Weeks of its laying cycle (North, 1984). Farooq *et al*., 2001 reported smaller per hen-housed egg production (188±0.56 eggs) representing 88±0.23% hatchable and 14±0.18%, unhatchable eggs than that reported by North (1984). Probable reason for that could be shorter egg laying cycle and poor rearing environment in former than in later case. Egg production is a function of feed consumed, age at point-of-lay, age at peak-of-lay, peak percent lay, percent hen-day egg production, laying period, rearing environment, health care and overall management of the flock. Thus, any variation in the aforementioned traits will result in a wide variability. Therefore, care must be exercised to fulfill all the production requirements in an appropriate way therebyensuring better productivity. Mortality plays a major role in the determining profits from broiler breeders as it is a function of dead and culled birds over the growth and production period. Higher mortality rate has been reported to adversely affect production performance of broiler breeders. Mortality and its negative association with net profit had also been reported (Farooq *et al*., 2001; Zahir-Uddin *et al*., 2001; Asghar *et al*., 2000). North (1984) reported poor economic performance of breeders at mortality level of more than 10%. Broiler breeders are usually produced in a healthy rearing environment to ensure better production performance. Keeping management factor to be constant, study of various production traits and developing standard limits for traits of economic importance would be more meaningful as it will enable the farmers to set their production goals and avoid unnecessary losses. Therefore this experiment was carried out with the following aim.

- To exploit the egg production performances of cobb-500 and arbor acres breeder strain.
- To find out the mortality rate cobb-500 and arbor acres breeder strain.
- To find out the hatchability performances cobb-500 and arbor acres breeder strain.
- To find out the requirement of feed (kg) intake per hatching egg of cobb-500 and arbor acres breeder strain.

CHAPTER II

REVIEW OF LITERATURE

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REVIEW OF LITERATURE

2.1 Poultry

The word "poultry" comes from the Middle English "pultrie", from Old French pouletrie, from pouletier, poultry dealer, from poulet, pullet. The word "pullet" itself comes from Middle English pulet, from Old French polet, both from Latin pullus, a young fowl, young animal or chicken. The word "fowl" is of Germanic origin (cf. Old English Fugol, German Vogel, Danish Fugl).

"Poultry" is a term used for any kind of domesticated bird, captive-raised for its utility, and traditionally the word has been used to refer to wildfowl (Galliformes) and waterfowl (Anseriformes). "Poultry" can be defined as domestic fowls, including chickens, turkeys, geese and ducks, raised for the production of meat or eggs and the word is also used for the flesh of these birds used as food. The Encyclopedia Britannica lists the same bird groups but also includes guinea fowl and squabs (young pigeons). In R. D. Crawford's Poultry breeding and genetics, squabs are omitted but Japanese quail and common pheasant are added to the list, the latter frequently being bred in captivity and released into the wild (Crawfor, 1990).In his 1848 classic book on poultry, Ornamental and Domestic Poultry. Their History, and Management, Edmund Dixon included chapters on the peafowl, guinea fowl, mute swan, turkey, various types of geese, the muscovy duck, other ducks and all types of chickens including bantams (Dixon and Rev Edmund Saul, 1848). In colloquial speech, the term "fowl" is often used near-synonymously with "domesticated chicken" (Gallus gallus), or with "poultry" or even just "bird", and many languages do not distinguish between "poultry" and "fowl". Both words are also used for the flesh of these birds. Poultry can be distinguished from "game", defined as wild birds or mammals hunted for food or sport, a word also used to describe the flesh of these when eaten.

2.2 Present position of poultry of Bangladesh

As we know poultry industry includes both the layer farms and broiler farms in the country. Large numbers of farms in different sizes are operating all over the country. The poultry industry was hit by bird flu in 2007, 2009 and 2011. The number of firms reduced to 55,000 in 2013 from 1,15,000 in 2007 due to outbreak of diseases along with other problems. Another source reported that there are about 65,902 poultry farms up to February 1013 in the country (BER, 2013). In two years since 2011, nearly 25,000 farms were closed mainly due to the outbreak of the diseases (Daily Star, 2013). There are 6 Grand Parent farms which supply 80% of the total demand for parent stock and rest 20% are imported. In the country 82 parent stock farms are operating and of producing 55-60 lakh DOC of broiler and 5 lakh Layer DOC per week.(Estimated by Breeder Association). Table 1 reveals that the highest consumption of egg per head per year was highest (48) in 2012 that means 53.85% are deficit as compared to minimum requirement of 104 eggs per head per year. Net availability and per capita consumption of chicken meat and eggs have been increasing from 199596 to 2012-2013. The fall in consumption and availability during 2006-67 to 2008-89 could be attributed to outbreak of avian influenza in the country.

Table 1. Availability and consumption of meat and eggs in the country Bangladesh

Year	Population Estimated (million)	Net Availability of meat (*000 m.ton)	Per capita consumption of meat(kg)	Net Availability of Egg (million number)	Per capita consumption of egg(no.)
1995-96	122.1	449	3.7	2564	21
1996-97	124.3	624	5.0	3470	27.9
1997-98	126.5	639	5.1	3691	29
1998-99	128.2	656	5.1	3926	31
1999-00	129.8	673	5.2	4177	32
2000-01	129.9	693	5.3	4446	34
2001-02	131.6	867	6.7	4446	33.8
2002-03	133.4	935.6	6.9	7026.0	52.0
2003-04	135.2	1020.2	7.4	8037.9	58.7
2004-05	137.0	1166.1	8.5	8037.9	58.6
2005-06	138.8	1130	8.14	5422	39.06
2006-07	140.6	1040	7.39	5369	38.18
2007-08	142.4	1040	7.30	5653.2	39.69
2008-09	144.2	1084	7.52	4692	32.53
2009-10	146.1	1264	8.65	5742.4	39.30
2010-11	149.7	1279	8.54	4211	28.12
2011-12	151.6	2332	15.38	7303.8	48.17
2012-13*	153.6	2532	16.48	5134.7	33.42

Note: 2012-13* Figures except population refer up to February 2013.

Source: *1995-96 to 1998-99 Statistical pocketbook of Bangladesh 2000.

*1999-00 Statistical pocketbook of Bangladesh2003.

*2000-01 to 2003-04 Statistical pocketbook of Bangladesh 2005.

*2004-05 Statistical pocketbook of Bangladesh 2012, *Population from 2001-02 to 2012-13Bangladesh Economic Survey 2013,

*Meat and egg from 2001-02 to 2012-2012-13 Bangladesh Economic Survey.

2.2.1 Contribution of poultry to society

Based on this poultry industry a number of industries are developed both in inputs sector and outputs sector along with a number of service providing organizations (Fig.1). Poultry industry contributes 1 per cent to the country's GDP while at least 60 lakh people are involved in the sector, but the industry lacks proper support from the government as claimed by stakeholders.

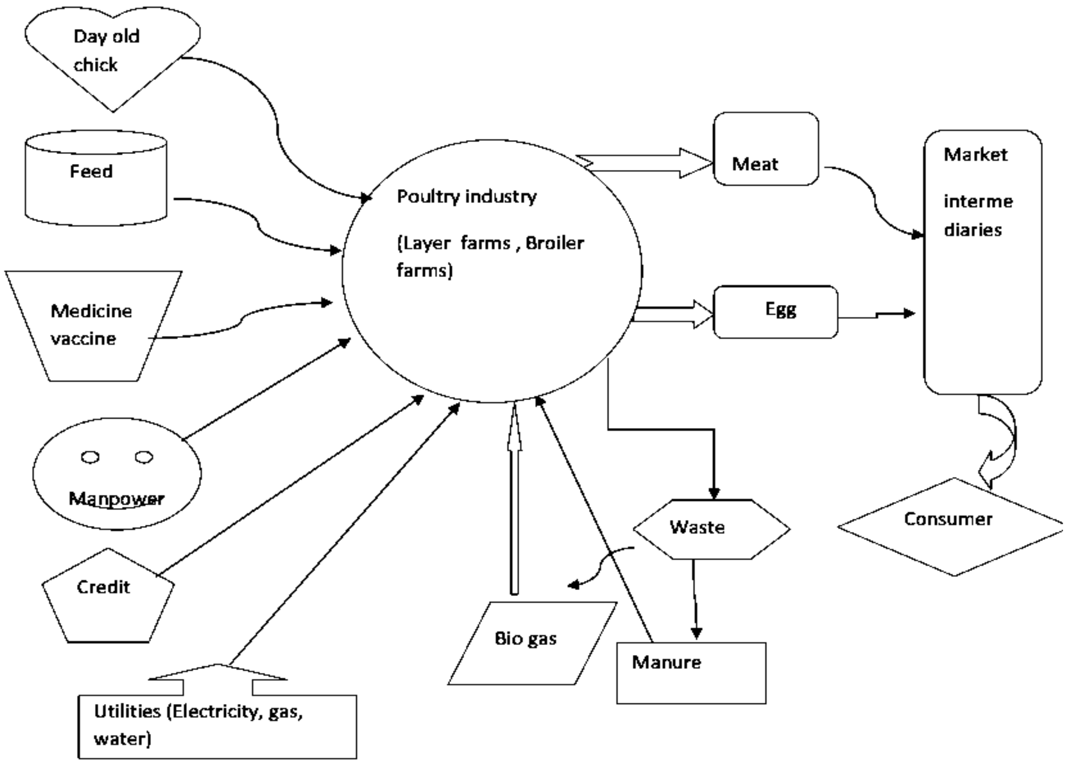


Fig 1. Poultry industry along with its input and output sectors

But an opposite picture is seen in Table 2. Actual production and the expected demand for poultry products are shown in Table 2. Table shows that production of chicken meat, egg and live chicken are larger than those of demand.

Table 2. Current demand and production of poultry and poultry products

Particulars	Production	Demand	Excess
Poultry meat (tons)/day	1500	1400	100
Eggs (crore)/day	1.6	1.5	0.1
Chicken (lakh piece) /week	95	85	1.0

Source: Bangladesh Poultry Association (2014).

Table 2 indicates that the country has achieved self-sufficiency in production of poultry products but the local poultry farmers are now facing losses due to lack of coordination between demand and supply (Round table conference, July 9 2014 Tribune 10 July 2014). It was highlighted that the farmers are incurring losses over few months due to excess production of chicken and egg. Excess production of chicken meat is forecasted by Business Monitor International which is presented in Table 3.

Table 3. Forecasts of production and consumption of chicken in Bangladesh

Year	Chicken meat lakh ton		
	Production	Consumption,	Excess
2012	1.98	1.39	0.59
2013	2.04	1.44	0.60
2014	2.10	1.50	0.60
2015	2.18	1.57	0.61
2016	2.25	1.64	0.61
2017	2.32	1.71	0.61

Source: BMI forecasts, 2013

2.2.2 Reasons for excess production of chicken meat

It is very important to note that although two-thirds of poultry farms are closed but the total production has increased rapidly. This could be due to increase production by large farms. It is also reported that the foreign entrepreneurs have doubled their farm production. But the demand has not increased rapidly so it creates a situation of excess supply of poultry products as compared to demand in the market. The excess production leads to lower price in the market. This does not cover even production cost. The leaders of this sector explained the excess production due to unplanned investment and expansion by the local entrepreneurs.

2.3 Market potential

2.3.1 Prospect in domestic market

According to WHO– FAO joint survey, meat consumption per head in Bangladesh is 15.23 kg per year while the requirement is 43.8 kg per person. So there is a deficit of 65.23 % to meet our domestic requirement. It may be noted that poultry contributes 35.25% of total meat supply (Akbar *et. al* 2013). On an average people consume 3.63 kg of poultry meat per year which is expected to be 5 kg by 2015 and 12 kg by 2021 (according to Poultry Association). So there is scope to increase chicken production by three times to meet the domestic requirement. Similarly, egg production can be increased by 61% for attaining minimum requirement of egg in the country. The per capita availability of egg is 41per year while the requirement is 104 i.e. 60.58% of deficit.

2.3.2 Export potentiality

Poultry industry has the potentials to export to India, Pakistan, Nepal, Malaysia, Indonesia and countries of Middle East. The consumption of meat in developing countries grew by 70 MMT from 26 MMT during last five years (Financial Express, 2014). This increasing trend will continue due to increase in population, higher income and health consciousness of the people.

2.3.3 What to do for harvesting market potential

A major problem in meeting nutritional requirement is lack of purchasing power of the consumers in the country. Undertaking Programmes to enhance purchasing power of the people through creation of productive activities is an important measure. Steps should be adopted to produce quality and safe food for both the domestic and export markets. To survive in the business a competitive environment is important which would ensure supply of all inputs at competitive price and also ensure remunerative price of poultry and its products for the producers. To enter the foreign market, the entrepreneurs should acquire competence in production of safe and quality products at competitive price. They should adopt Hazzard Analysis and Critical Control Point (HACCP) system to ensure production of safe and quality product. They should also comply with food hygiene and trade regulations. We need to enforce sanitary and phytosanitary measures based on standards, guidelines and recommendations of Codex Alimentarius Commission, the International Animal health Organization (OIE).

3.1 Misconception about egg

3.2 Brown Eggs Healthier Than White Eggs

There is no difference in nutrient contents between brown and white –shelled eggs. But consumers prefer brown-shelled eggs to white shelled eggs considering more nutritious. So price of brown-shelled egg is higher than that of white-shelled egg in the market. Secondly, brown feather chicken lay brown eggs, they are larger in size that white ones, so they eat more food, which in turn costs farmers more. And it is the consumer who pays for that. The selection of commercial white layer and brown layer should be based on their comparative advantage as feed intake of brown layer is higher and slight price advantage for brown eggs but no difference in quality.

3.2.1 Eggs from local poultry vs farm eggs

In the market eggs of indigenous chicken fetch higher price per unit than the farm supplied eggs as a segment of consumers consider Deshi egg as more tasty and nutritious. But there is no scientific support on this point. Size and type of eggs have no different impact on the taste. But volume of nutrient contents will vary with size.

3.2.2 Colour of egg yolk

Some consumers believe that deep yolk colour is the sign of more tasty and nutritious than the pale yolk colour. Presence of xanthophylls pigment in feed is responsible for yellow colour of egg yolk (Akter *et al*., 2011). Now synthetic xanthophyll is available in the market for yolk colouration.

3.2.3 Organic eggs are more nutritious than regular eggs

Organic eggs are produced by hens using organic feed, free from antibiotic, growth hormones and enzymes. If the organic feed is not well balanced as the commercial layer feed, then the nutritive value of organic eggs tends to be lower than the regular eggs (Watkins, 1994). Organic feed is expensive than commercial feed and production of organic eggs is lower thus organic eggs are sold at higher price compared to regular eggs (Das *et al.*, 2014).

3.2.4 Consumption of eggs and heart disease

There is a tendency to avoid use of egg as it may cause cardiovascular/heat disease. But in fact, fat in egg yolk is mostly composed of unsaturated fatty acid, which may have very little effects on blood cholesterol levels. Research findings support that daily egg consumption has a very limited effect on total cholesterol in healthy individuals (Ohman *et al*., 2008).

3.2.5 Removal of misconception

Misconception about egg are age old but not based on scientific reasoning, these are either due to ignorance or mere taboos. By removing these misconceptions from the people through market development tools (Kohls and Uhl, 2005) will generate a good market for poultry egg and meat in the country. Market development activities should be launched by the members of the poultry industry. Government support will accelerate the programmes.

3.2.6 Challenges

The major challenges to poultry sector are limited access to credit, competition from foreign firms and outbreak of diseases like Avian Influenza. The foreign firms have been investing in poultry sector in Bangladesh. They are borrowing money from their banks at a cheaper rate of interest i.e.4%. But the local entrepreneurs borrow funds with the rate of 15-to 18%. So the local firms are unable to compete with the foreign firms. (The Daily Financial Express "Let poultry sector stand on its own", February 14, 2013).

In addition following points need quick attention

a) Most of the poultry farmers are young who have started farming without having any prior training and management orientation.
b) Slaughtering of poultry birds in open space in marketplace is the common practice which may help in outbreak of diseases.
c) Lack of reliable data in poultry sector and its unplanned growth in the country is a great concern for development of poultry industry in the country.
d) There is national poultry development policy 2008 in Bangladesh. But the policy has not been implemented in field.
e) Unorganized poultry farmers at rural area throughout the country.

How to face the challenges

The problem of limited access to credit can be solved through government policy, change in attitudes of the bankers and the poultry entrepreneurs. Foreign farms are large in size and vertically integrated so the non-integrated local farms will not be able to compete with them. If the expansion of vertically integrated firms continues then ultimately non-integrated small and medium poultry farms will disappear from the market. And its consequences will not be beneficial for the nation. Approximately 50 companies control over 65% of world's poultry production (Mulder, 2013). So, it needs government intervention. Avian influenza is a great threat to poultry industry. To reduce the threat the country should have surveillance system for the virus in poultry and migratory birds (Haque *et al.,* 2013). This debate on methods of control of avian influenza in the country. Experts' opinion should be sought in taking decision by the Government. The persistent co-circulation of natural H5N1/H9N2 viruses along with poor biosecurity measures underlines the importance of providing poultry farmers and small-holder poultry producers with educational programs about appropriate control measures for avian influenza (Monne *et al*., 2013). Training on poultry rearing and management should be mandatory for the poultry farmers. All farms should be registered with government office at DLS Selling of live birds in the market may be phase out step by step. Lack of data on poultry sector is one of the obstacles for proper planning and implementation of any developmental programmes. So establishment of a reliable and comprehensive data bank is prerequisite for the development of the poultry industry. Poultry development policy should be implemented for the development of poultry sector. Poultry farmers at rural areas throughout the country are operating the poultry farms independently and highly unorganized. If they are organized, then the picture of poultry industry will be different. All the stakeholders will be benefited from the action of the farmers' organization (Sarker, 2013).

3.2.7 Export market

There is a group of entrepreneurs who have intention to go for export market with chicken meats and eggs. The interested group may be encouraged to prepare themselves for export markets about good production practices, processing of safe and quality product through adoption of HACCP System and compliance with trade regulations. Growth in poultry products export not only brings in additional foreign exchange for the country but benefits a large number of people involved in the production, processing and export of such products.

4.1 Cobb- 500 broiler chicken

Often, the companies producing high performances broiler chicken breeds provide to poultry industry certain technical data describing hybrid performance, nutritional requirements and management parameters. Thus, according to Cobb-vantress (http//:www.cobb-vantress.com/products/cobb-500,) Cobb-500 broiler chicken is the world's most efficient broiler chicken and has the lowest feed conversion, best growth rate and an ability to thrive on low density, less costly nutrition. These attributes combine to give the Cobb-500 the competitive advantage of the lowest cost per kilogram of live-weight produced for the growing customer base worldwide.

These competitive advantages include but are not limited to

1. Lowest cost of live weight produced
2. Superior performance on lower cost feed rations
3. Most feed efficient & excellent growth rate
4. Best broiler uniformity for processing
5. Competitive breeder

Furtherance to the above advantages, other qualities of the Cobb-500 broiler chickens over the other breeds are summed up by the cobb-vantress company in the following selected parameters:

4.1.1 Feed Conversion

Feed is now 60% of the total cost of producing a broiler chicken. Therefore, feed costs are forecast to remain high for the next 1-2 years and hence efficient feed utilization becomes the most influential input in the management of livestock production cost. In this regard, Cobb selection programs have emphasized efficiency and feed conversion as high priorities in the development of the Cobb-500 broiler chicken breed and this has helped Cobb to achieve the lowest cost of producing a kilogram of meat in markets around the world. Furthermore, efficient feed conversion and excellent growth rate assist in the customer's goal of achieving a target weight with the competitive advantage of lowest cost. Cobb combines both attributes in the world's most successful broiler, the Cobb-500.

4.1.2 Feed Cost

Lowest feed conversion ratio together with the ability of the Cobb500 to thrive on lower density, less expensive feed, reduces the cost of producing chicken meat. Thus, when lower density feed with reduced nutrient levels is fed to the Cobb-500 broiler chicken it decreases feed ingredient costs without affecting performance. According to the Cobb Company, the following table illustrates feed cost savings by feeding a lower density feed from a one million bird/week operation due to efficient feed utilization by the Cobb-500 broiler chicken breed. Thus, the company estimates that the saving are over $2.8 million/year.

4.2 Cobb-500 Breeder

The Cobb-500 is a competitive breeder, providing excellent egg and chick numbers to complement the superior performance of the world's most efficient broiler. Since the production and availability of day-old chicks is influenced by total eggs produced, mortality percentage, fertility and hatchability percentage respectively, the above table becomes very important. Thus, as suggested by (Wilson, 1991) hatchability is a typical fitness trait with low heritability which may indicate that improvement by selection will take a long time to produce measurable results and hence optimization of hatching total eggs produced and hatchery management therefore seems to be the most promising route for improvement

Table 4: Global Cobb-500 breeder performance in comparison to global output among other chicken breeder strains to 65 weeks - ranked according to total eggs per hen hatched.

Parameter	**Average**	**Top 25%**	**Top 10%**
Total Eggs	162.2	177.0	182.8
Hatching Eggs	157.4	170.3	174.8
Chicks	131.2	129.8	142.3
Mortality %	9.5	5.9	4.7

Source: (http//:www.cobb-vantress.com/products/cobb-500)

4.2.1 Production characteristics of Cobb-500 broiler chickens in comparison to other chicken breeds

Although the above competitive advantages as outlined by cobb-vantress company are straight related to the technological conditions provided by farmers, it remains contestable based on results of experimental evaluation of production performance parameters of Cobb-500 broiler chickens and other breeds. Therefore, the following review will emphasise on the results achieved during the intensive husbandry of different meat-type hybrids of chicken mainly Arbor acres, Cobb-500, Hubbard and Ross broiler chicken breeds focusing on those performances concerning dressed weight, slaughtering efficiency, proportion of the main cut parts in whole carcass structure and growth dynamics (Skrbic *et al.*, 2007) compared body mass and dynamics of growth of broiler chickens of different genotypes namely Cobb-500 line broiler chicken and an Arbor acres broiler line in improved rearing conditions. The results of their study indicate initial differences in growth dynamics of these broiler chickens with an initial more intensive growth of Cobb chickens which reached the maximal values of average daily gains in the fifth week of age (67.40 g) and then with a tendency to decrease in daily gains after the fifth week of age. However, this growth dynamics was contrary to those of chickens of Arbor acres genotype which had continuous growth, so the highest daily gain was achieved in the last, sixth week of age (75.60 g). Though in spite of these initial established differences in growth dynamics, final body masses of Cobb and Arbor Acres chickens weren't statistically significant (2175.67 and 2153.90 g) at 42 days of age. The authors concluded that initial differences in growth dynamics among the two chicken genotypes were probably as a result of differences in selection programme applied to these chicken breeds. Also, in another separate study with Cobb-500 and Ross broiler chicken breeds, (Chepete *et al.,* 2008) found that there were no significant differences between production performance parameters of the Cobb-500 and Ross broilers. However, these authors concluded that in general for all parameters studied, the trends of the production performance parameters showed that Cobb broiler chicken breeds had slightly higher values which were not significantly different than the Ross broiler chicken. (Souza *et al.*, 1994) showed that some breeds have presented a continuous genetic progress in traits of economic interest. In this evaluation, the breeds Ross, Cobb and Hubbard had a higher breast yield than Arbor Acres breed. (Vieira and Moran, 1998) evaluated the carcass yield of 49-day-old chickens from four different breeds and found no difference in the yield, but differences of up to 20% in the amount of abdominal fat were verified between different commercial breeds. (Flemming *et al*., 1999) compared the yield of the carcass and of parts of five commercial breeds: Ross, Cobb, Hubbard, Arbor Acres and Isa Vedette, and registered differences only between Ross and Cobb from the others, which showed a smaller yield. Comparing Ross with Cobb, the first had the best yield of boneless leg. On the other hand, in another evaluation, (Moreira *et al.,* 2003) and (Stringhini *et al.*, 2003) verified no difference in the yield of carcass or cuts between Ross and Cobb breeds. In relation to the productive performance, these authors observed that 10both breeds showed a similar satisfactory performance. Compared the productive performance of Ross and Cobb breeds with two Embrapa breeds and no significant difference was detected at the age of 56 days for any productive parameter(Moro *et al.*, 2005). Apparently, the above observations support the fact that different breeding companies started to apply their knowledge in quantitative genetics differently towards the selection of meat type chickens (Havenstein *et al.,* 2003). In most cases, this selection programs focused on the differences in growth dynamics, increment of growth rate, increasing muscle yield, improvement in feed conversion and decreased age to slaughter of commercial broiler chickens. The result was “high- yield” chicken strains that require approximately 1/3 of the time and over a threefold decrease in the amount of feed consumed to reach desired slaughter weights as compared to what existed five decades ago (Havenstein *et al.,* 2003). Furthermore, in 2004 Tona and colleagues compared incubation parameters, one day old chick weight, chick quality, and broiler growth to 7 and 41 d of age, as well as heat production, corticosterone and T3/T4 levels in plasma in 3 different commercial lines of broiler breeders. The differences in heat production before day 18 of incubation and the different levels of corticosterone in plasma after hatch suggested different metabolic rates between the three lines. With their research results it has become accepted that the embryos from high-yield broilers have different physiological characteristics and therefore different incubation requirements than classic or genetic lines of previous generations. Again, the above observations on lack of statistically significant differences in final growth rate of Cobb and Arbor Acres chickens at 42 days of age by (Skrbic *et al.,* 2007), and the results of (Chepete *et al.,* 2008) who found that there were no significant differences between production performance parameters of the Cob 500 and Ross broilers as well as the findings of (Moreira *et al.,* 2003) and (Stringhini *et al.*, 2003) who verified no difference in the yield of carcass or cuts between Ross and Cobb chicken breeds contradict the above claim of the Cobb-500 broiler breeder company as the breed with the “best growth rate” and therefore makes the above competitive advantages of Cobb broiler chicken breeds as outlined by the Cobb company questionable.

4.2.2 Arbor acres chicks

The Arbor Acres Plus is available in two types, one which produces sexable broilers and one that produces all fast-feathering broilers. The sexable type produces fast-feathering female broilers and slow-feathering male broilers. This allows broilers to be sexed in the hatchery by evaluating feather development differences between sexes. The fast-feathering type produces broilers that are all fast-feathering. They cannot be sexed in the hatchery by evaluating feathers because males and females grow their feathers at the same rate. Parent females for both types are very similar. They should have the same growth profile, and require the same feeding regime and their egg production should be the same. It is important to manage the breeders so they do not come into production too early. If they reach 5-10% production prior to 25 weeks of age early egg size will be reduced, resulting in smaller chicks.An important consideration when bringing flocks into production is the timing of photo-stimulation. In-season females should be photo-stimulated at 154 days while out-of-season flocks may be photo-stimulated at 147 days. Daily egg production, feed clean-up and body weights should be evaluated on a daily basis from 5% production through post peak production and feed amounts adjusted appropriately. Eggs from the Arbor Acres Plus may hatch faster than eggs from other female.

The Standard performance at 64 weeks of Arbor acres are following.

Parameter	Average
Total Eggs	185.2
Hatching Eggs	177
Chicks	151
Mortality %(Laying Period)	8
Feed intake Per Hatching Egg	307

Source: Arbor Acres Plus Parent Stock Performance.

4.2.3 Chick Performance of Arbor Acres

The Arbor Acres says their chicks are good performance (Mortality, Weight Gain) but we get information by flowing review and literature.

(Sarker *et al*., 2001) done experiment on three strain (Arbor Acres, ISA Vedette and Hybro) of there performance (Weight Gain and Feed Consumption) where these are higer in Arbor Acres and Hybro than ISA vedette. Survivability and feed efficiency among the strain are non significant, although Arbor Acres showed slightly higher survivability other than two. The significant difference ($P<0.001$ and $P<0.0$) in Cobb-500, Hubbard Classic and Arbor Acres in rainy season. Body weight at fourth weeks of age were significant differences ($P<0.05$) among the three broiler strain in rainy season. There was no significant differences($P>0.05$) in feed consumption among the three broiler strain at first and third weeks of age. Body weight was also differed non-significant ($P>0.05$) at first, second and third weeks of age. The feed conversion ratio among the three broiler strain at second and third week of age were significant differences ($P<0.05$).

(Farran *et al.,* 1993)reported that Arbor Acres Strain is heavier and lower FC other than Hybro N and Hybro G. Abdominal fat pad is more in Arbor Acres than Hybro N and Hybro G. The performances of local chickens were lower than those of the Arbor chickens under identical conditions ($P<0.0001$). They have a weight at 16 weeks (1249g) and a total DWG weak (10.81 g/d), whereas the Arbor have a BW at 8 weeks (2383g) and a total DWG (41.66 g/d). The growth rate for local chicken (K=0.156/w) is lower than for Arbor (K=0.354/w). The feed intake of concentrates during 16w by local chicken are comparable with the Arbor chicken at 8w ($P>0.05$) thus showing a good valorization of the pasture by local chicken (14.4%). Feed conversion ratio (FCR) for local poultry was relatively high (3.97) and their livability of is comparable to the Arbor ($P>0.0001$), this shows well thermo-tolerance of local chicken and its rusticity ($P<0.0001$). The ultimate pH after 24h of slaughtering was relatively high (6.1) for local poultry compared to Arbor (5.79) and color parameters in the main muscles were particularly intense for local poultry. The carcass of local poultry is thin and low in fat ($P<0.0001$).

4.2.4 Effect of strain on poultry production performance

The genetic makeup associated with different attributes of individuals creates variation and similarities among individuals. Taking advantage of this variation various strains, varieties and breeds have been evolved with unique attributes of economic importance. In case of chicken, an important segment of these attributes is hatching traits which are of vital importance for sustained production of high yielding broiler and layers. The strains of chicken differ in hatchability, hatching time, chick weight and many other parameters. More intense genetic selection for breast yield over other characters has resulted in decreased hatchability in broiler breeders.

A recent study revealed significantly high hatchability of total and fertile eggs, less hatching time, higher weight loss during incubation and higher chick weight at hatch in Gimmizah strain of chickens compared with Mandarah strain and heavier body weights in different stages of grow out compared to those for Mandarah. Earlier studies also support these view that fertility, hatchability (Burke *et al.,* 1990; Soliman, 2000) hatch time (Burke *et al.,* 1990; Christensen *et al.,* 2000) and chick weight at hatch (Wilson, 1991) are affected by chicken strain. Strains differ in internal organ weight, residual yolk sac mass and chick carcass reserves, and therefore chick weight also differs among strains (Wolanski *et al.,* 2007). Earlier studies have also shown interaction effects of strain with age on chick weight

(Hamidu *et al.*, 2007). A great variation was observed in shell porosity and weight losses of ostrich eggs from different hens indicated wide genetic variability (Wilson, 2003). Embryos from modern broiler genetic strains 4produced more heat at the end of incubation compared to strains not highly selected for growth (Fasenko *et al.,* 2009). The genetic strain also affected chick length and weight (O'Dea *et al.*, 2004) whereas different strains have different incubation times. In two experiments hatch weight has been shown to be affected by strain and age differences in experiment-1 but not in experiment-2. Strain effect on hatchability, chick quality and broiler growth has also been reported (Lapa˜o *et al.,* 1999; Tona *et al.,* 2002)

4.2.5 Effect of age (Production phases) on poultry production performance

The age of the hen can influence hatchability, chick quality and broiler growth performance (Lapa˜o *et al.,* 1999; Tona *et al.*, 2002). Reports demonstrated that at pre-peak egg production phase the hen laid eggs and produced chicks that weighed less; however the eggs had strong shell that required longer the time to complete the hatching process (Pedroso *et al*., 2005). In two experiments hatch weight was affected by strain and age in experiment-1 but not in experiment-2 A significant reduction in incubation time was observed for chicks produced from 50 week old hens compared with 34 week old hens at peak production phase (Afifi et al. 2010; Latour *et al*., 1996) reported that breeder age influenced subsequent embryogenesis and hatchability of broiler eggs. The age of the parent flocks influenced subsequent fertility (Tona *et al.*, 2001). Eggs from birds during pre-peak and peak represented higher significant ($p<0.05$) percentages of fertility and hatchability, egg quality, and hatch time those from layers in post and terminal production phases (Rizk *et al*., 2008). A decrease in the incubation length was reported in flocks at post- peak and terminal production phases (Smith and Bohren, 1975). The eggs produced from hens at pre-peak production phase needs the longer time required to complete the hatching process (Pedroso et al., 2005). The parental age had no significant effect on hatchability percentages of fertile and total eggs incubated. Data regarding macroscopic fertility demonstrate that flock at terminal phase of production had lowest fertility and the result was parallel to those of (Deeming and Van Middel Koop 1999), who reported that fertility percentage was related to hen age and those older demonstrated lower fertility. On the other hand, different authors reported that age had a significant effect on fertility and hatchability (Peebles *et al.,* 2000; El Attar and Fathi, 2002). Whereas a significant difference between flock ages on fertility but not on hatchability (El-Sheikh, 2007). Several reasons have been ascribed to be the primary cause of poor fertility and greater incidence of nonviable germs in eggs of breeder hens at pre-peak production phase (Wilson, 1991; Pedroso *et al.,* 2005). These include small thick shelled eggs from young breeders and inability of smaller chicks produced from those eggs to break the shell during hatching, resulting in death after piping (Pedroso *et al.,* 2005), and less movement of water vapor and respiratory gases due to lower eggshell conductance of young breeders (Christensen *et al.,* 2005). Hatchability of eggs of older breeders at terminal production phase decreases because of poor albumen quality (Lapão et al. 1999; Tona et al. 2004), more yolk cholesterol (Dikmen and Sahan, 2007) and decreased shell thickness (Bennett, 1992) which may be the reason for early hatching eggs from older breeders when compared with younger breeders. Holding time prior to incubation can also decrease hatchability (Vieira and Mora, 1998; Joseph and Moran, 2005). Eggs from older breeders are larger with larger embryos; thus, they produce more heat during incubation and may also affect hatchability. Earlier reports have also shown that one day old chick weight increased due to an observable increase of parental age in Japanese Quails (Reis *et al.,* 1997). On the other hand, embryonic mortality increased in eggs of hens at terminal production phase compared to hens at pre-peak production phase (Novo *et al.,* 1997). There was an effect of flock age on the percentage of infertility with an increase recorded in two strains. Although the magnitude of increase was higher for Ross than for Cobb eggs, strain did not influence the incidence of infertile eggs and there was no significant interaction between strain and flock age (Deeming and Van Middel Koop, 1999). Parental age had affected the embryo mortality in early, middle and late periods and this weight was excessive in 66 weeks old hens at terminal phase of production (Sahan and Ipek, 2000). The researchers reported that the fertility and hatchability of incubated eggs decreased in the older breeder flock (Elibol *et al.,* 2002).The hatchability of fertile eggs in 10 and 20 weeks old Japanese quails was 74.72 and69.44 percent, respectively. In addition, higher hatchability of fertile eggs was also observed in young group during pre-peak production when compared with older flock during terminal phase of production. Fertility and hatchability of all eggs set and hatchability of fertilized eggs did not differ between two hen ages of 32-35 and 44-50 weeks. Embryonic mortality was also reported to differ between different hen ages in a commercial strain of turkeys. A negative correlation between fertility and early embryonic mortality was found in eggs from young turkey hens (Fairchild *et al.,* 2002). Parental age had no statistically significant effect on chick weight; however, it was determined that the egg weight had a statistically significant effect on chick weight. A significant level of increase was noted in hatchability of fertile eggs due to increasing age (Seker *et al.,* 2004). Hatchability from fertile eggs is significantly better in younger flocks than older flocks (Elibol and Brake, 2006). Hatching eggs produced by older breeders at terminal phase of production have been shown to be larger in size and they also exhibit areduced fertility (Abudabos, 2010).

4.2.6 Factors related to fertility

Fertility of Chicken is a very important measure of their reproductive efficiency (Malecki *et al*., 2004). The problem of unfertilized eggs has long been identified as one of the most critical factors limiting the success of breeding programmes and ranges from 10.0-98.2% both within and between farms (Hicks, 1993; Deeming, 1995, 1996a; Dzama *et al*., 1995; More, 1996; Badley, 1997; Schalkwyk van *et al*., 2000; Park *et al*., 2001; Malecki and Martin, 2003a; Mushi *et al*., 2008; Dzoma and Motshegwa, 2009). Breeder infertility can broadly be categorized into hen infertility, mainly involving the failure to lay eggs (barrenness) and cock infertility, involving mainly the inability to supply viable spermatozoa and the subsequent production of candling-clear eggs. Candle-clear eggs indicate infertility and therefore a breeding problem and are often, but not always, associated with an infertile cock. Candling is the act of shining a light through an egg to observe, whether it is clear (infertile), or not. Eggs are deemed to be infertile when candling results at days 7-10 of incubation show an apparent lack of embryonic development (Ley *et al*., 1986). However, such cases may be difficult to distinguish from eggs, whose embryos died early in the incubation period, generally referred to as Early Embryonic Death (EED), because in both cases, the candling results may be similar. However, when EED eggs are opened up, an embryonic disc, which is absent in infertile eggs, can be seen floating (Hicks, 1993).

Breeder factors that influence fertility include young and old age, disease, nutrition, mating behavior and efficiency and possibly testicular cysts, while the non breeder factors include high stocking densities, extreme environmental temperatures and season (Hicks, 1993; Deeming, 1995, 1996a; Aire *et al*., 2003; Lambrechts *et al*., 2004). It is unclear, whether fertility is inheritable in thechicken (Badley, 1997), but it can be affected by inbreeding (Dzama *et al*., 1995). Inbreeding is known to cause elevated rates of infertility in domesticated animals, primarily because of homozygous expression of recessive lethal alleles (Charlesworth and Charlesworth, 1987; Thornhill, 1993).

Cock infertility

Cock infertility is generally associated with the production of candling-clear eggs. Male chicken mature sexually at about 21 week of age. The reproductive organs of the male consist of the testis and the (ductus) epididymis. The size and appearance of the testis varies with age and stage of the testicular cycle, enlarging up to 400% of its normal size during breeding (Bezuidenhout, 1986; Madekurozwa *et al*., 2002). With sexual maturity generally comes the ability to produce viable spermatozoa capable of fertilizing the egg following a successful mating. Attempts to breed the male before it attains sexual maturity can lead to the production of infertile eggs since juvenile male only exhibit spermatogenic activity, but are devoid of viable spermatozoa (Madekurozwa *et al*., 2002).

Hormonal imbalances of testosterone or Follicular Stimulating Hormone (FSH) levels in cocks may interfere with spermatozoa production (Degen *et al*., 1994; Black, 1995; Rozenboim *et al*., 2003). These hormones are also responsible for the crimson colour of shins and skin around the eyes of the cock, as well as the aggressive behavior of male during breeding. The latter behaviour is also thought to positively influence egg production in the hen through the initiation of ovulation (Lambrechts *et al*., 2000). Not much work has been done regarding the specific association between breeding ratios and fertility rates. However, Deeming (1996a) observed higher fertility (>90%) in females kept in male: female breeding ratios of 1:2 than in females in groups with larger numbers of females per male. In contrast, Lambrechts *et al*., 2004 observed that increasing the number of females per male did not have negative influences on reproductive traits (fertility, hatchability and total number of eggs produced) and observed significantly higher production among breeders in male: female ratios of 1:10. This concurred with the study of Malecki and Martin, 2003a of sperm supply on the Germinal Discs (GD) of fertilized eggs. They observed less sperms on the GD of eggs from pens with less females per male and concluded that it was a waste of a male’s capability to keep him with only one or two females and that the most efficient ratio would be 1 male with 10 females. Malecki and Martin, 2003a concluded that hens generally have high fertility and that any infertility could be associated with a lack of sperm supply. This was based on an apparent difference in sperm supply between breeder pens with different cocks. It would then appear that what is lacking in reproduction is an effective tool for pre-season Breeding Soundness Examination (BSE) of cocks, a routine practice in other animal production systems. The assessment of semen quality characteristics of the poultry species gives an excellent indicator of their reproductive potentials and is a sine quanon to effective artificial insemination programmes (Zahraddeen *et al*., 2005). As feed is the greatest input cost in ostrich production (Aganga *et al*., 2003), the use of fewer hens per cock, like the 1:1.4 noted in the work of Mushi *et al*., 1999 in some farms in Botswana could jeopardize the economics of ostrich production through the unnecessary feeding of extra males. When all the breeders are in optimal breeding condition, the use of male: female ratios of 1:10 (quads) (Lambrechts *et al*., 2004) would significantly reduce production cost at no further cost to productivity.

Naturally, the male is polygamous, usually having one major hen and two or more minor ones and copulates up to three times a day, while the clutch is being laid (Bertram, 1992; Kimwele and Graves, 2003). While the importance of the frequency of copulation has not been well studied, it could, as in other birds, be related more to sperm competition and paternity assurance than to the necessity to fertilize eggs (Birkhead *et al*., 1987, 1989).

The female has sperm-storage tubules at the utero-vaginal junction of the oviduct (Bezuidenhout *et al*., 1995; Madekurozwa, 2002) and have a fertile period that ranges from 5-28 days post-coitus (Birkhead, 1988; Bezuidenhout *et al*., 1995; Swan and Sicouri, 1999; Malecki *et al*., 2004). Another factor that can affect egg fertility is the mixing of incompatible breeders Deeming, 1996a, resulting in no mating activity. In a study involving two breeding groups, Bonato *et al*., 2009 noted that about 77.5% of offspring were sired by only about 50% of the males, suggesting very limited participation by the other 50% of the males. The researchers inferred that female mate preferentially with one specific male. However, it could also have been a reflection of the mating efficiency of the males, with the other 50% not in optimal breeding soundness, since no examination had been carried out prior to breeding. As earlier discussed, Hemberger *et al*., 2001observed wide ranges in vital spermiogram parameters in breeding males. Therefore, in addition to BSE, compatible birds have to be selected before the start of the breeding season. The mixing of incompatible breeders may have been responsible for the use of more cocks on the farm in a bid to circumvent the effects of breeder incompatibilities that manifest as infertility.

In some cases, females with black pigment and rudimentary male sexual organs are recognized as males and rejected for mating (Mushi *et al*., 2008). Also that coloration of wing and neck feathers and the brightness of the black feathers of males appear to influence the size of the egg laid by females mated to them (Bonato *et al*., 2009) further emphasizes the need for continued Another technique that can be adopted in order to diagnose reproductive wastage and to detect low fertility cocks is the assessment of sperm numbers in the outer perivitelline layer of eggs, combined with observing the appearance of the germinal disk in unincubated eggs (Malecki and Martin, 2003b). This facility could increase the efficiency of breeding flocks either by selecting superior males or by optimizing sex ratios for the mating.

Hen infertility

Egg production per hen per year is an important parameter to estimate reproductive performance in breeding farmed (Bronneberg *et al.*, 2007b). The female matures sexually at about 22 weeks of age, after which it starts laying eggs, undergoing varying stages of ovarian activity. The reproductive organs of the hen comprise the ovary and oviduct with only the left ovary and oviduct being the ones that develop (Fowler, 1991). Ovarian size, shape and ultrastructural morphology vary with stages within the breeding cycle and resemble a bunch of grapes in mature, reproductively active hens (Bezuidenhout, 1986; Madekurozwa, 2007). Hen infertility is generally regarded as failure to lay eggs. It may be temporary and a failure to lay eggs should not immediately preclude the hen from future breeding. Biologically, egg production in the hen involves a cascade of events involving hormonal stimulation in sexually mature hens (Degen *et al.*, 1994).

As stated under male infertility, the breeding season of the chicken depends on increasing daylength (Hicks, 1992; Degen *et al.*, 1994; Soley and Groenewald, 1999). In seasonal breeding birds, increased daylength results in the hypothalamus producing and secreting Gonadotrophin Releasing Hormone (GnRH), which in turn stimulates the anterior pituitary gland to produce and release Follicle Stimulating Hormone (FSH) and Leutenising Hormone (LH) into the circulatory system (Sharp, 1996). The ostrich hen has a 48 h ovarian cycle. Ovarian follicles grow under the influence of LH, resulting in the production and secretion of gonadal steroids such as estrogen (Bronneberg *et al.*, 2007b). Plasma LH significantly increases one month before the start of the breeding season and decreases toward the end of the season (Degen *et al.*, 1994; Bronneberg *et al.*, 2007b). Estrogen levels increase at the start of the egg laying season, peaks, when egg production is maximal and remains elevated for the rest of the breeding season (Bronneberg *et al.*, 2007b). The same researchers further noted that ovulation occurs about 2 h after oviposition, while progesterone, LH and estrogen reach peak concentrations shortly before ovulation. Ultra-structural differences (Madekurozwa, 2007), most likely associated with hormonal levels, have also been noted between uteri of hicken in and out of their active ovarian phases.

The development of the ovarian follicles and reproductive health status in the female can be detected and monitored by ultrasonography (Bronneberg and Taverne, 2003). This technological development could play a major role in the future with respect to determining and intervening on some hen related causes of infertility. Ultrasonography could also play a big role in breeder selection, in discriminating between ovulating and non-ovulating hens and in quantifying the egg production potential of individual hens at the start of the season, considering that characteristics like egg production are satisfactorily repeatable and predictable (Schalkwyk van *et al*., 1996; Lambrechts *et al*., 2002b; Bronneberg and Taverne, 2003; Bronneberg *et al*., 2007a, b). These advances may, as is the case with poultry (Etches, 1990), set the stage for improved egg production and ultimately enterprise viability. Hen infertility can also be a result of females that retain too few sperms after mating, or that retain sperms for a shorter time in their sperm storage tubules (Malecki and Martin, 2002).

Nutritional causes of infertility

Nutrition is a vital aspect of animal breeding. Birds, like other animals need energy to carry out the actual process of mating and also invests some nutrients in the eggs. In chicken, egg size, an indicator of maternal investment (Heaney and Monaghan, 1995), is actually also a good predictor of hatchling mass as well as chick survival at 1 month of age (Bonato *et al*., 2009). Starving ostriches are also less likely to be able to breed, while deficiencies of macro and micro nutrients can adversely affect fertility, hatchability and chick survival.

Feeds containing energy levels lower that 8.5 MJ Metabolisable Energy (ME) kg^{-1} Dry Matter (DM) can affect body condition of breeders and can decrease egg production by as much as 28%.Diets containing 8.5 MJ ME kg^{-1} DM and 105 g kg^{-1} protein should be regarded as the minimum that can be used for breeding female without compromising egg production. Brand *et al*., 2003 Overfeeding of breeders can lead to obesity, which condition is associated with a decrease in libido (Aganga *et al*., 2003).

An interesting aspect of feeding breeder is the documented competition for absorption from the gastro-intestinal tract between calcium and zinc (Gregor, 1988; Somer, 1995). Calcium is required for egg production among other important functions, while zinc is vital for spermatogenesis, where its supplementation in poultry enhances fertility and hatchability (Barney *et al*., 1968; Anshan, 1990). Theoretically therefore, increasing dietary calcium to cater for the hen’s needs may compromise intestinal absorption of zinc in the male since both sexes are fed on the same ration. The question would be whether the sexes would need to be fed separately and if it would be feasible since they need to be together to encourage mating. Vitamin A and E deficiencies have often been associated with infertility.

Vitamin A is important in the maintenance of epithelia, including testicular epithelium. Chicken eggs have been found to contain high levels of selenium in shell and shell membranes at 1785 and 1904 μg Se kg^{-1}, respectively, which is available for use by the developing embryo (Golubkina and Papazyan, 2006). Vitamin and mineral requirements and deficiency syndromes in poultry are well documented (NRC, 1994). Such data for ostriches is scant.

Table 5: Some effect of vitamin & mineral deficiencies and excesses in chicken breeders on egg production and embryo and chick performance (Angel, 1993)

Vitamins	**Effects**
Vitamin E	Early embryonic mortality-circulatory failure, High mortality of chicks soon after hatch
Riboflavin (B2)	Embryos exhibit dwarfing, altered limb and mandible development, edema, defect in the down development(clubbed down)
Folic Acid	Defects of the mandible , deformed beaks
Mineral	
Manganese	Skull deformities, parrot beak, Increased incidence of thin shelled & shell less eggs
Iodine	Incomplete closure of navel
Selenium excess	Reduce egg production Reduce hatchability Embryonic abnormalities

However, summarized some reproductive effects associated with mineral and vitamin deficiencies in ostriches (Table 5).

Influence of disease on fertility

The importance of good health on reproduction can never be over emphasized. Many diseases may result in reproductive failure, either through failure to produce eggs or through production of abnormal or contaminated eggs (Cabassi *et al.*, 2004). Diseases affect an animal's fertility in a number of ways. Chronic diseases such as aspergillosis or avian tuberculosis may cause reduced fertility before clinical signs become noticeable. Internal parasites may result in debility directly or via a decrease in the availability of essential nutrients to the animal (Shanawany, 1999). External parasites may cause irritation, general disturbance and sometimes blood loss.

Influence of husbandry on fertility

In an experiment involving heat stress in broilers, high temperatures were found to decrease male fertility (Karaca *et al*., 2002). Average egg production, fertility and hatchability are also compromised when stocking rate is high in chicken (Lambrechts *et al*., 2004).

4.2.7 Factor Related to Hatchability

Hatchability denotes the percentage of fertile eggs that hatch successfully following an appropriate incubation period, which is 21days in the chicken at 36.9°C and 49-53% dry bulb humidity. Hatchability therefore, basically involves losses owing to embryonic death at various stages of development. Various hatchability rates have been noted the world over, ranging from 27-67% and is on average below those found in chicken (Bertram and Burger, 1981; Deeming, 1996a; More, 1996; Badley, 1997).

Influence of temperature on hatchability

The incubation temperature for hen eggs is 36.5°C (Stewart, 1996; Hassan *et al*., 2004). The researchers also noted an increase in the incidences of dead-in-shell embryos and total number of dead embryos, when eggs are incubated at 37.5°C. Towards the end of incubation, the temperature inside the egg rises by 2.0°C above the surrounding air temperature, as a result of metabolic heat production by the embryo (French, 1997). This may result in the death of the embryos due to hyperthermia, when the same incubation temperatures are maintained throughout incubation (Hassan *et al*., 2004). Ideally, incubation temperatures should regress, decreasing slightly as the embryo develops (Deeming, 1993).

Moisture loss and hatchability

The incubation humidity for chicken eggs is considered to be 48-53 % dry bulb humidity. This humidity enables incubating eggs to lose between 13 and 15% of their original weight in the form of moisture and is an important determinant of hatchability (Rahn *et al*., 1977; Philbey *et al*., 1991; Foggin and Horneywill, 1992; Deeming, 1995; Christensen *et al*., 1996;

Nahm, 2001). Egg shell properties play an important role in determining hatchability. During development, oxygen, carbon dioxide and water vapor are transported in to and out of the egg through pores in the egg shell (Rahn, 1981). The ability of the ostrich egg to lose moisture therefore, depends on parameters like shell porosity, shell thickness and incubation humidity among others (Gonzalez *et al*., 1999). It is thought that advances in ostrich breeding will lead to the production of eggs with consistent size and shell characteristics that could lead to improved hatchability as in poultry (Deeming, 1996a; Badley, 1997). According to the researchers, chicken eggs that possess low porosity and have increased thickness hatch poorly. Egg weight has also been shown to influence hatchability, with large eggs having problems losing the required amount of water, having reduced oxygen uptake and being consequently frequently associated with edema chicks (Deeming, 1993; Hassan *et al*., 2005). However, Bonato *et al*., 2009 noted better chick survival at 1 month of age in larger eggs. Excessive moisture loss above 18% to about day 35 of incubation puts chicks hatching from such eggs at higher risk of dying before they attain the age of 28 days (Cloete *et al*., 2001).

Egg contamination and hatchability

Egg contamination can be lethal to the embryo even at low doses. The degree of yolk contamination is influenced by the degree of egg contamination before egg setting (Deeming, 1995, 1996b; Musara and Dziva, 1999; Cabassi *et al*., 2004). Mushi *et al*., 2008 observed a 7.3% hatchability depression associated with microbial contamination of eggs. Microbial contamination of eggs can result from the dipping or washing of eggs in liquid disinfectants before setting them into incubators that possibly leads to the disruption of the protective cuticle of the egg shell (Huchzermeyer, 1996; Richards *et al*., 2002). As a result, fumigation should be routinely carried out before setting eggs in to the incubator in order to avoid egg washing (Huchzermeyer, 1996; Mushi *et al*., 2008). Various microbes have been associated with chicken egg contaminations and include bacteria (*Escherichia coli*, *Aeromonas* sp., *Enterobacter* sp., *Acinetobacter* sp., *Citrobacter* sp., *Streptococcus faecalis*, *Klebsiella* sp., *Staphylococci* sp., *Bacillus licheniformis* and *Achromobacter* sp.) and fungi (*Penicillium* sp. and *Fusarium* sp.) (Foggin and Honywill, 1992; Deeming, 1995a,b, 1996b; More, 1996; Welsh *et al*., 1997; Musara and Dziva, 1999; Cabassi *et al*., 2004; Mushi *et al*., 2008).

Other factors affecting hatchability

Reports suggest that prolonged pre-incubation storage of over 14 days below 21°C and high breeder stocking density have a negative effect on hatchability (Deeming, 1996a, b; Badley, 1997; Gonzalez *et al*., 1999; Nahm, 2001; Lambrechts *et al*., 2002a; Sahan *et al*., 2004; Hassan *et al*., 2005). Hatchability can also be affected by poor nutrition, especially that involving a deficiency or imbalance of minerals and vitamins (Perelman *et al*., 2001). Breeder age as measured from the first season of breeding, as well as breeding season also affects hatchability. Other factors include altering the setting, turning and angle of rotation in the incubator (Ipek and Sahan, 2004; Brand *et al*., 2007).

CHAPTER III

MATERIALS AND METHODS

CHAPTER III

MATERIALS AND METHODS

5.1 General Statement

The study was conducted at Hybrid farms Limited, Kazi Farms Group at Panchagarh district using two upgrade strain of Chicken. The strains are Cobb-500 which is product of cobb-vantress and Arbor Acres Plus which is product of Aviagen Group.

The experiment was completed under four separate arrangements;

- Comparison of egg production & comparison of hatching performances.
- Mortality during laying period & feed intake per Hatching Egg.

There are used 10 flock, where 5 Cobb-500 flock and 5 Arbor Acres flock. Each flock number of bird was 8000.

5.2 Housing System

The bird was reared in environmental control house. The area of house are 420 X 50 sq feet. There were used tunnel ventilation system, where used Evaporating system. In these system 10 ventilation fans were used. The Evaporating Cooling pad are present on in front of shed and two side of shed. The total area of Evaporating Cooling pad is 600 square feet. The speed of per fan is 440 RPM.

Fig 2: In front of Shed with Evaporating Cooling System.

Fig. 3: Tunnel Ventilation

5.3 Rearing System of Bird

The birds are reared in salt cum litter system where the portion of salt is 16 feet at two side, the litter situated at middle portion of shed which is 18 inch. Rice husk was used as litter materials. The depth of rice husk at production period was 6 inch.

Fig 4: Litter cum Salt System

5.4 Biosecurity of Farm

Cleaning and Biosecurity plays a vital role in the management of poultry in order to avoid various bacterial, viral, fungal and protozoan diseases. To secure our farm against various infections by following very simple but important measures are used as follows:-

1. Going s to shed after bath by shampoo and soap and used separate cloths and sleepers for worker.
2. Before entering the shed, workers wash their hands and feet with suitable disinfectant.
3. Provide disinfectant foot-bath at gate of the farm and at the entry of each shed.
4. We ensure that visitors/ vaccinators have not visited affected farm before coming to our farm
5. Vehicles carrying the ready birds to market or cull-bird van should never enter the farm.
6. Dispose of dead birds by deep burial as soon as possible.
7. Used litter should be disposed off away from the farm premises at the earliest.
8. We do not allow stray Dogs, Vultures and other stray birds into our farm.

All in All out system is strongly recommended.

5.5 Cleaning and disinfection in between two flocks

1. Remove all organic materials e.g. manure, litter, feathers & dust etc. Preferably after spraying 5 to 10% formalin and disposal of same in closed containers like gunny bags or plastic bags.
2. Remove all waterers, feeders, and curtains. Clean and wash thoroughly with a jet of water and then with washing soda solution. Afterward dip them in viricidal disinfectant of prescribed dilution and contact time. Sun dry for two days.

3. All organic matters disposed of away from farm premises in deep pits with formalin spray, caustic soda, salt etc.
4. Clean even the fans, bulbs, tubes, wire nets and water tank. Remove all water from pipe line and fill the whole watering system with 5 to 10% solution of sodium hypochlorite (or Aquaquat, Aquaclean, Vigrox in recommended doses) keep it overnight or at least for 3-4 hours. Flush the system with plain water to remove the solution.
5. **Chemical treatment**: Floor were soaked with strong solution of caustic soda 11 to 12 gms. per litter of water or 1.2 kg per 1000 sq. ft for 12 to 24 hrs then wash with plate water.

Rewash the flooring by spraying any good disinfectant

a. Quaternary Ammonium compound likes Disendet, Protek, and Aldepol at 20 ppm. conc

Or Idophore compound like Saniphore, Polidine at 100 ppm. Conc.

1. In case of tick, mites beetles shed were sprayed with Malathion or Cythion @ 8 to 15 ml. per liter of water.
2. **Whitewash** the shed with lime slurry with 1% Kerosene, 0.5% Formalin, and 0.5% Copper sulfate. In case of previous history of any viral infection or high mortality Aldepol, Disendet, Protek can also be added.
3. **Fumigation:** Before actual fumigation refix all washed and disinfected curtains. For 100 cu. Ft. use 20 gm. of potassium permanganate and 40 ml. of formalin. Keep the shed closed for 24 hr. then unfold the curtains.
4. At the end of 48 to 72 hr. before the arrival of chicks spray viricidal disinfectants like Disfect-s, Virkon-s, Qualitrol, Halamid

   Used effective concentrations are as follows

   a. Disfect-s : 2.5 ml per liter
   b. Virkon-s : 4 gm. per liter of water
   c. Qualitrol : 4 ml. per liter of water
   d. Halamid : 4 gm. per liter of water

Fig 5: Washing of Vehicle before entering in farm.

Table 6: Vaccine used in broiler breeder strain.

Vaccination age		Vaccine Name		Route	Dose
Week	Day	Type	Brand Name		
0+1	1	IB Live	Bioral H-120	I/O	
0+3	3	Coccidiosis Live	Immocox	D/W	
0+4	4	NDLive	Clone 30	I/O	
1+5	12	REO Live	REO S1133	S/C	
2	14	IBD Live	D-78	M/D	
2+4	18	ND live	Clone 30	I/O Left Eye	
		IB Live	491	I/O Right Eye	
		ND Killed	Newcavac	S/C	**½ dose**
3	21	IBD Live	IBD 228E	M/D	
		Fowl Pox Live	Diffosec	W/W	
6+3	45	MG Killed	MG Vax	I/M	
8+0	56	Coryza Killed	Corvac	I/M	
		ND+IB Live	MA5+Clone30	I/O	
10+0	70	REO Killed	REO Inac	I/M Left side	
		ND Killed	Newcavac	I/M Right side	
		ILT Live	Gallivac	M/D	
11+4	81	MG Killed	MG Vax	I/M Left side	
		AE+Pox Live	Poximune AE	W/W	
		CAV Live	CAV -P4	I/M Right side	
13+4	95	ND live	Clone 30	I/O Left Eye	
		IB Live	491	I/O Right Eye	
		Coryza Killed	Corvac	I/M	
15+4	109	EDS Killed	EDS Killed	I/M	
17+0	119	ILT Live	Gallivac ILT	M/D	
		ND+IB Live	MA5+Clone30	I/O	
27+2	191	ND+IB Live	MA5+Clone30	D/W	
35+2	247	ND+IB Live	MA5+Clone30	D/W	
43+2	303	ND+IB Killed	Nobilis IB+ND	I/M	

5.6 Feeding Practice

Nutrition of feed: There are Four types of feed were used in both strain those are breeder 1, breeder 2 for male feed during production time. Metabolic energy, Moisture (%), Crude Protein (%), Crude Fiber (%),Fat (%),Ash (%),Calcium & and Phosphorus(%) of eight types are following.

Table 7: Chemical composition of feed ingredients used for broiler breeder strain

%	Pre-Breeder(AA-002)	Breeder-1(AA-004)	Breeder-2(AA-005)	Male Breeder Feed(AA-006)
Metabolic Energy	2760	2847	2848	2756
Crude Protein	13.6	14.55	14	11.88
Crude Fibre	3.83	2.64	2.37	3.62
Fat	6.4	3.28	3.94	5.38
Ash	7.6	10.94	9.41	7.2
Calcium	1.2	3.07	3.1	1.1
Phosphorus	0.8	0.72	0.65	0.6
Moisture	9.96	9.7	9.9	9.2

The female change 2 times during production 1st one after first laying pre breeder to breeder 1 and second time at 45 weeks of age breeder-1 to breeder-2.Incase of male feed change in 1 time at the age of 45 weeks pre layer to male breeder.

5.6.1 Feeder Type

We had use chain feeder for female and pan feeder for male. We use gunny cloth for separate feeding.

- Feeding space for female was 6 inch/bird.
- Feeding space for male was 1 pan for 10 birds.

Fig 6: Chain Feeding System of Female & Pan Feeding of male

Fig 7: Separate Feeding of Male and Female By using Gunny Cloth

5.6.2 Watering

Water is very important for egg production .The water percentage in egg is 66%.Water also a source of infection of disease. We used bleaching to purifying the water.
Here we used nipple drinker and 10 birds per nipple.

Fig 8: Nipple Drinker

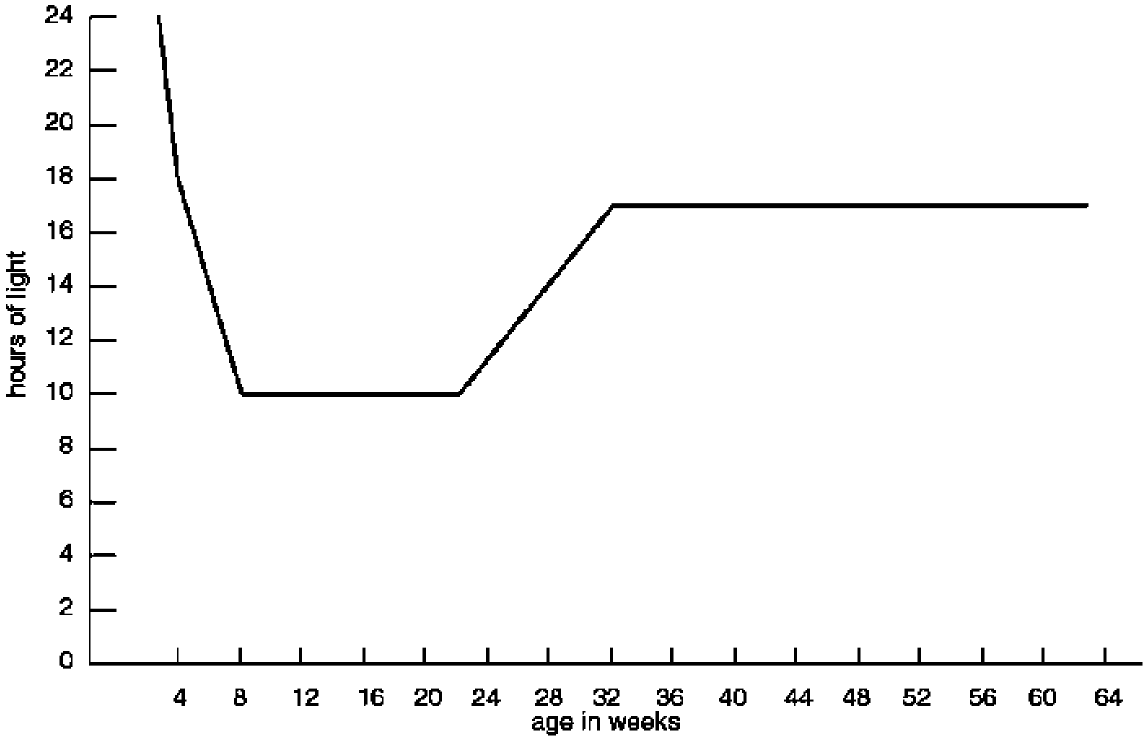
5.7 Nesting System

We have used manual nest. The nesting place for the birds are 80 pc/box. The size of the nest box are 2.5 feet × 5 feet.

Fig 9 : Manual Nesting System

5.8 Light

At the brooding stage the light hours were different at different time. After mixing of male and female the light hours and intensity were increasing .Light intensity was near about 60 lux the lighting hour was 16 hours.



5.9 Egg Collection

Egg collection is important for getting good hatchability. If delay to collect egg the egg will be broken by chick, we collect egg 5 times per day. The time is 8.30 am,10.30 am,12 pm, 2.30 pm and 4.30 pm.

5.9.1 Egg Production

To compare the rate of egg production, the data of every flock were collect everyday. The eggs were collected 5 times daily. To measure average egg weight 10 % of total eggs were weighed by an electric Balance. The rate of egg production was expressed as the "Hen-day egg production" Using the following formula:

$$\text{Hen-day egg production (\%)} = \frac{\text{No. of egg laid}}{\text{No. of hen in house}} \times 100$$

5.9.1.1 Factors affecting the egg Production

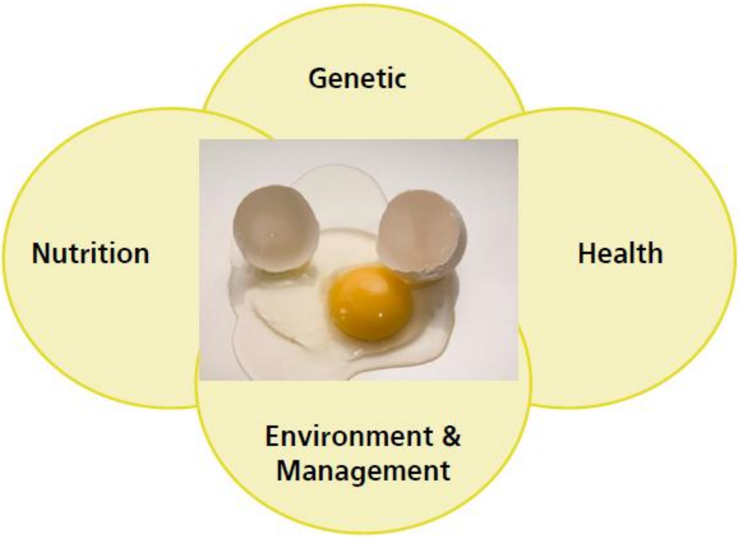


Figure 10: Factors affecting the egg production

Typically, a broiler breeder layer's production cycle lasts 42-46 weeks. During the production cycle many factors influence egg production; therefore, the cycle must be managed effectively and efficiently in order to provide maximum output and profitability. The following factors influence the egg production.

5.9.1.2 Chicken Factors

Breed:The breed of the laying bird influences the egg production. Management and feeding practices, however, are the key determining features for the egg production.

Mortality rate:Mortality rate may rise due to disease, predation or high temperature. The mortality rate of small chicks (up to eight weeks of age) was about 4 percent; that of growers (between eight and 20 weeks of age) was about 15 percent; and that of layers (between 20 and 72 weeks of age) was about 12 percent. The average mortality rate of a flock was 20 to 25 percent per year.

Age:Birds typically begin producing eggs in their twenty or twenty-first week and continue for slightly over a year. This is the best laying period and eggs tend to increase in size until the end of the egg production cycle.

Body weight:In general, optimum body weight during the laying period should be around 2.8kg, although this varies according to breed. Underweight as well as overweight birds lay eggs at a lower rate. Proper management and the correct amount of feed are necessary in order to achieve optimum body weight.

5.9.1.3 Management Problems

Laying house:The laying house should be built according to local climatic conditions and the farmer's finances. A good house protects laying birds from theft, predation, direct sunlight, rain, excessive wind, heat and cold, as well as sudden changes in temperature and excessive dust. If the climate is hot and humid, for example, the use of an open house construction will enable ventilation. The inside of the house should be arranged so that it requires minimum labor and time to care for the birds.

Lighting schedule:Egg production is stimulated by daylight; therefore, as the days grow longer production increases. In open houses, found commonly in the tropics, artificial lighting may be used to increase the laying period. When darkness falls artificial lighting can be introduced for two to three hours, which may increase egg production by 20 to 30 percent.

In closed houses, where layers are not exposed to natural light, the length of the artificial day should be increased either in one step or in a number of steps until the artificial day reaches 16 to 17 hours, which will ensure constant and maximized egg production. Effective day length should never decrease during the laying period feed, but only if they are improved breeds or crossbreeds. The selection of local hens is done on the basis of resistance and other criteria rather than feed utilization for production.

Fresh and clean water should always be provided, as a layer can consume up to one-quarter of a liter a day.

Collection of eggs:Frequent egg collection will prevent hens from brooding eggs or trying to eat them and will also prevent the eggs from becoming damaged or dirty.

Culling:Culling is the removal of undesirable (sick and/or unproductive) birds, from the flock. There are two methods of culling:

- mass culling, when the entire flock is removed and replaced at the end of the laying cycle; and
- Selective culling, when the farmer removes individual unproductive or sick birds.

Culling enables a high level of egg production to be maintained, prevents feed waste on unproductive birds and may avert the spreading of diseases.

5.9.1.4 Climate

The optimal laying temperature is between 11° and 26° C. A humidity level above 75 percent will cause a reduction in egg laying. Figure 2 indicates the effect temperature has on egg production.

Table 8: Temperature and its effects on egg production

Temperature (°C)	Effects
11 - 26	Good production.
26 - 28	Some reduction in feed intake.
28 - 32	Feed consumption reduced and water intake increased; eggs of reduced size and thin shell.
32 - 35	Slight panting.
25 - 40	Heat prostration sets in, measures to cool the house must be taken.
40 and above	Mortality due to heat stress.

Source: Kekeocha, 1985

When the temperature rises above 28° C the production and quality of eggs decrease. Seasonal temperature increases can reduce egg production by about 10 percent.

5.9.1.5 Feed-Related Problems

Not enough drinking water

Clean and cool water must always be available to avoid heat stress. Lack of water results in reduced egg production.

No feed or decreased feed intake

Chickens tend to eat less when the feed is not tasty or when they are stressed because of environmental temperatures, especially when it gets too hot. Feed should be available at all times. When chickens are not well fed, egg production decreases

Low calcium in the feed

- This result in few and smaller eggs, soft-shelled eggs, shell-less eggs, cracked eggs, eggs losing color and hens having leg problems.
- If calcium deficiency is suspected, take a feed sample to the laboratory to check the calcium level.
- Commercial rations have calcium added. When mixing your own ration make sure that calcium added is 3, 5 %.

- If calcium deficiency is a problem, limestone grit should be given as a top dressing at least twice a week at 5 gm. /bird.

5.10 Fertility

The rate of fertility was expressed as the "Percentage of total egg set" Using the following formula:

$$\textbf{Fertility (\%)} = \frac{\textbf{No. of fertile eggs}}{\textbf{No. of egg set}} \times \textbf{100}$$

5.11 Hatchability

The rate of hatchability was expressed as the "Percentage of total egg set" Using the following formula:

$$\textbf{Hatchability (\%)} = \frac{\textbf{No. of chick hatched -out}}{\textbf{No. of egg set}} \times \textbf{100}$$

5.12 Mortality

The record of the mortality was kept every day. At last day of week the weekly mortality rate calculate. The formula used in mortality is following

$$\textbf{Weekly Mortality (\%)} = \frac{\textbf{Total mortality of Whole Week}}{\textbf{Bird Number at housing}} \times \textbf{100}$$

5.13 Feed intake per hatching egg

Feed cost contributes about 65 to 70 of total farm cost. We estimate the feed gram per hatching egg. For this parameter calculate every day feed (kg) of both male and female. It was calculate by end of week .Every parameter related to thesis are keep in Record every day. At end of the week all parameter summarized and compared to last week.

5.14 Statistical analysis

All data were presented as mean ± SEM. To compare data among groups and one way ANOVA (Analysis of Variance) factor analysis was performed. The data obtained in the present investigation were analyzed with SPSS statistics 20.0 software. Probability $P<0.05$ was considered statistically significant.

CHAPTER IV

RESULTSAND DISCUSSION

CHAPTER IV

RESULTS AND DISCUSSION

The experiment was completed under four separate arrangements; Comparison of egg production , comparison of hatching performances , mortality during laying period & feed intake per Hatching Egg. There were used 10 flock, where 5 Cobb-500 flock and 5 Arbor Acres flock. Each flock housing bird number was 8000.

6.1 Egg Production

The average weekly egg production of Cob -500 and Arbors Acres were recorded from 25 to 64 weeks. Egg production of all flocks were observed and result are shown in (Table 8). The average egg production of Cobb-500 and Arbor Acres from 25 to 29 weeks of age were 68.172 ± 8.849 and 59.08 ± 10.26, from 30 to 34 29 weeks of age were 79.76 ± 0.893 and 74.92 ± 0.257, from 35 to 39 29 weeks of age were 74.24 ± 0.851 and 75.12 ± 0.25, from 40 to 44 29 weeks of age were 69.16 ± .652 and 71.88 ± 0.557, from 45 to 49 29 weeks of age were 63.68 ± 0.935 and 66.60 ± 0870 , from 50 to 54 29 weeks of age were 57.32 ± 1.03 and 60.40 ± 0892, from 55 to 5929 weeks of age were 51.40 ± 0.629 and 54.32 ± 0826, from 60 to 6429 weeks of age were 46.76 ±0.724 and 47.88 ± 08662 Table 8).

The highest egg production of Cobb-500 were observed in between 30-34 weeks of age (79.76 ± 0.893) and the lowest in between 60-64 weeks of age (46.76 ±0.724). The highest egg production of Arbor Acres was observed in between 35-39 weeks of age (75.12 ± 0.257) and the lowest in between 60-64 weeks of age (47.88 ±0.86).

There was no significant difference ($p<0.05$) in egg production between Cobb-500 and Arbor Acres strain(68.17 ± 8.849 and 59.09 ± 10.263) at 25-29 weeks of age, (79.76 ± 0.893 and 74.24 ± 0.851) at 30-34 weeks of age , (74.92 ± 0.257and 75.12 ± 0.25) at 35-39 weeks of age and (46.76 ± 0.724and 47.88 ± 0.866) at 60-64 weeks of age but significant difference among two strain at the age of 40-44, 45-49, 50-54 and 55-59, weeks. (Table 8).

A broiler breeder hen usually starts egg production at the age of 23-24 weeks and produces around 183 hatchable eggs out of 199 total hens housed eggs produced in 65 Weeks of its laying cycle (North, 1984).

The study with Cobb-500 and Arbor Acres broiler chicken breeds, (Chepete *et al.*, 2008) found that there were no significant differences between production performance parameters of the Cob 500 and Arbor Acres broilers. However, these authors concluded that in general for all parameters studied, the trends of the production performance parameters showed that Cobb broiler chicken breeds had slightly higher values which were not significantly different than the Arbor Acres chicken. However, egg production can be affected by many other external factors such as specific feed ingredients, bird age and flock management decisions. Small degrees of over or under feeding have been shown to negatively impact egg production (Renema *et al.,* 2008).

Table 9: Performance of two broiler breeder strain. Egg production

Treatment	Week 25-29 (Mean ± SE of Mean)	Week 30-34 (Mean ± SE of Mean)	Week 35-39 (Mean ± SE of Mean)	Week 40-44 (Mean ± SE of Mean)	Week 45-49 (Mean ± SE of Mean)	Week 50-54 (Mean ± SE of Mean)	Week 55-59 (Mean ± SE of Mean)	Week 60-64 (Mean ± SE of Mean)
Cobb-500	68.1720 ± 8.84913	**79.7600 ± .89308**	74.2400 ± .85182	69.1600 ± .65238	63.6800 ± .93509	57.3200 ± 1.03073	51.4000 ± .62929	**46.7600 ± .72498**
Arbor Acres	59.0800 ± 10.26384	74.9200 ± .25768	**75.1200 ± .25768**	71.8800 ± .55714	66.6000 ± .87864	60.4000 ± .89219	54.3200 ± .82608	**47.8800 ± .86626**
P-value	0.00	0.008	0.00	0.0132	0.0524	0.0538	0.0228	0.00
Significant	**NS**	**NS**	**NS**	*****	******	******	*****	**NS**

6.2 Hatchability

The weekly average hatchability of Cobb -500 and Arbors Acres were recorded from 25 to 64 weeks. Hatchability of all flocks was observed and result is shown in (Table 10). The average hatchability of Cobb-500 and Arbor Acres from 25 to 29 weeks were 79.5180 ± 4.48294 and 77.0740 ± 2.70478, from 30 to 34 weeks were 90.8580 ± 0.35716 and 83.6740 ± 0.68246, from 35 to 39 weeks were 92.4060 ± .10260 and 88.1880 ± .42407 , from 40 to 44 weeks were 92.0680 ± 0.11249 and 89.0140 ± 0.20061 , from 45 to 49weeks were 90.5800 ± 0.30995 and 86.9080 ± 0.31666, from 50 to 54 weeks were 86.4760 ± 0.80809 and 81.4900 ± 0.97512, from 55 to 59weeks were 80.3060 ± 0.90327 and 76.8160 ± 0.63826, from 60 to 64 weeks were 75.7640 ± 0.34243 and 73.4300 ± 0.35355 (Table 9).

The highest hatchability of Cobb-500 were observed in between 35-39 weeks (92.0680 ± 0.11249) and the lowest in between 60-64 weeks (75.7640 ± 0.34243). The highest hatchability of Arbor Acres were observed in between 40-44 weeks (89.0140 ± 0.20061) and the lowest in between 60-64 weeks (73.4300 ± 0.35355).

There were no significant difference ($p<0.05$) in hatchability between Cobb-500 and Arbor Acres strain(79.518±4.482 and 77.074±2.7042407) at 25-29 weeks (90.8580±.3571 and 83.6740±.68246) at 30-34 weeks(92.4060±.10260 and 88.1880±.42407) at 35-39 weeks and (92.0680±.11249and 89.0140±.20061) at 40-44 weeks of age but significant difference were found between two strains at the age of 45-49, 50-54, 55-59 and 60-64 weeks (Table 9) but these two strains hatchability performances of cobb-500 was significantly higher than Arbor Acres strain.

The strains of chicken differ in hatchability, hatching time, chick weight and many other parameters. More intense genetic selection for breast yield over other characters has resulted in decreased hatchability in broiler breeders (Butcher *et al.*, 2002). A recent study revealed that significantly high hatchability of total fertile eggs, less hatching time, higher weight loss during incubation and higher chick weight at hatch in Gimmizah strain of chickens compared with Mandarah strain and heavier body weights in different stages of grow out compared to those for Mandarah (Afifi *et al.*, 2010).

Earlier studies also support these view that fertility, hatchability (Burke *et al.*, 1990; Christensen *et al.*, 2000; Soliman, 2000) hatch time (Burke *et al.*, 1990; Christensen *et al.*, 2000) and chick weight at hatch (Wilson, 1991) are affected by chicken strain . The age of the hen can influence hatchability , chick quality and broiler growth performance (Lapa˜o *et al.*, 1999; Tona *et al.*, 2003).

Table 10: Hatchability of two broiler breeder strains

Treatment	**Week 25-29 (Mean ± SE of Mean)**	**Week 30-34 (Mean ± SE of Mean)**	**Week 35-39 (Mean ± SE of Mean)**	**Week 40-44 (Mean ± SE of Mean)**	**Week 45-49 (Mean ± SE of Mean)**	**Week 50-54 (Mean ± SE of Mean)**	**Week 55-59 (Mean ± SE of Mean)**	**Week 60-64 (Mean ± SE of Mean)**
Cobb-500	79.5180 ± 4.48294	90.8580 ± .35716	92.4060 ± .10260	92.0680 ± .11249	90.5800 ± .30995	86.4760 ± .80809	80.3060 ± .90327	75.7640 ± .34243
Arbor Acres	77.0740 ± 2.70478	83.6740 ± .68246	88.1880 ± .42407	89.0140 ± .20061	86.9080 ± .31666	81.4900 ± .97512	76.8160 ± .63826	73.4300 ± .35355
P-value	0.00	0.00	0.00	0.00	0.0125	0.0043	0.0135	0.0015
Significant	**NS**	**NS**	**NS**	**NS**	*****	*****	*****	*****

6.3 Feed intake per hatching egg (kg)

The average weekly requirement of feed intake per of hatching egg in Cobb -500 and Arbors Acres were recorded from 25 to 64 weeks. Feed requirement (kg) per hatching egg of all flocks was observed and results are shown in (Table 10). The average of feed requirement of Cobb-500 and Arbor Acres from 25 to 29 weeks were 0.2820 ± 0.04543 and 0.3240 ± 0.06742, from 30 to 34 were 0.2200 ± 0.00000 and 0.2360 ± 0.00245, from 35 to 39 were 0.2300 ± 0.00000 and 0.2220 ± 0.00200 , from 40 to 44 were 0.2380 ± 0.00200 and 0.2300 ± 0.00000, from 45 to 49 were 0.2540 ± 0.00245 and 0.2480 ± 0.00374 , from 50 to 54 were 0.2840 ± 0.00510 and 0.2720 ± 0.00374 , from 55 to 59 were 0.3120 ± 0.00374 and 0.3000 ± 0.00447 , from 60 to 64 were 0.3420 ± 0.00583 and 0.3340 ± 0.00510 (Table 10).

The highest feed requirement of Cobb-500 were observed in between 60-64 weeks (0.3420 ± 0.00583) and lowest in between 30-34 weeks (0.2200 ± 0.00000). The highest feed requirement of per hatching egg of Arbor Acres were observed in between 60-64 weeks (0.3340 ± 0.00510) and lowest in between 60-64 weeks (0.2220 ± 0.00200).

Table 11: Feed intake per hatching egg (kg) of two broiler breeder strain

Treatment	Week 25-29 (Mean ± SE of Mean)	Week 30-34 (Mean ± SE of Mean)	Week 35-39 (Mean ± SE of Mean)	Week 40-44 (Mean ± SE of Mean)	Week 45-49 (Mean ± SE of Mean)	Week 50-54 (Mean ± SE of Mean)	Week 55-59 (Mean ± SE of Mean)	Week 60-64 (Mean ± SE of Mean)
Cobb-500	.2820± .04543	.2200 ± .00000	.2300± .00000	.2380± .00200	.2540± .00245	.2840± .00510	.3120± .00374	.3420± .00583
Arbor Acres	.3240± .06742	.2360 ± .00245	.2220± .00200	.2300± .00000	.2480± .00374	.2720± .00374	.3000± .00447	.3340± .00510
P-value	0.012	0.00	0.0139	0.00	0.00	0.0943	0.0736	0.3319
Significant	*	NS	*	NS	NS	**	**	**

There were no significant difference ($p<0.05$) in feed requirement of per hatching egg between Cobb-500 and Arbor Acres strain at age of 30-34, 40-44 and 45-49 weeks but significantly difference were found in other remaining weeks of age (Table 10).

6.4 Mortality

The average weekly mortality of Cobb -500 and Arbors Acres were recorded from 25 to 64 weeks. Mortality of all flocks were observed and result are shown in (Table 9). The average mortality of Cobb-500 and Arbor Acres from 25 to 29 weeks were 0.2960±0.05278 and 0.7400±0.20067 , from 30 to 34 were 0.3740±.02502 and 0 .8420±0.15055, from 35 to 39 were 0.4080±0.06280 and 0.7260±0.12552, from 40 to 44 were 0.2900±0.02470 and 0.4800±0.04461, from 45 to 49 were 0.3280±0.04779 and 0.5720±0.07412 , from 50 to 54 were 0.6080±0.07499 and 0.8780±0.13399 , from 55 to 59 were 0.7980±0.16590 and 1.0960±0.20636 , from 60 to 64 were 0.9600±0.07543 and 1.2260±.05519 (Table 9).

Table 12: Mortality of two broiler breeder strain

Treatment	**Week 25-29 (Mean ± SE of Mean)**	**Week 30-34 (Mean ± SE of Mean)**	**Week 35-39 (Mean ± SE of Mean)**	**Week 40-44 (Mean ± SE of Mean)**	**Week 45-49 (Mean ± SE of Mean)**	**Week 50-54 (Mean ± SE of Mean)**	**Week 55-59 (Mean ± SE of Mean)**	**Week 60-64 (Mean ± SE of Mean)**
Cobb-500	.2960± .05278	.3740± .02502	.4080± .06280	.2900± .02470	.3280± .04779	.6080± .07499	.7980± .16590	.9600± .07543
Arbor Acres	.7400± .20067	.8420± .15055	.7260± .12552	.4800± .04461	.5720± .07412	.8780± .13399	1.0960 ± .20636	1.2260 ± .05519
P-value	0.0648	0.0154	0.0533	0.0058	0.0244	0.1167	0.2930	0.0216
Significant	**	*	**	*	*	**	**	*

The highest mortality of Cobb-500 were observed in 60 to 64 weeks (0.9600±0.07543) and the lowest in 40 to 44 weeks (0.2900±0.02470). The highest mortality of Arbor Acres were observed in 60 to 64 weeks of age (1.2260±0.05519) and the lowest in 40 to 44 weeks of age (0.4800±0.0446). There is no significant difference ($p<0.05$) in mortality between Cobb-500 and Arbor Acres strains at different age of weeks (Table 11).

CHAPTER V

CONCLUSION

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Commercial poultry production has been growing rapidly in Bangladesh since early 1990 by using improved breeding practice, quality manufactured feeds and good management system. This dramatic growth of breeding practice poultry farms throughout the country has taken place without judging feasibility of the farm in the area. This improvement is done mainly in the private sector as a device for additional source of income and employment opportunities particularly in rural area. This process has been influenced by the programmes of different NGOs and the public sector. Background of poultry industry in Bangladesh may be seen in Raha (2013).

Cobb-500 broiler showed the highest egg production performance in 30 -34 weeks of age and the lowest egg production performance in 60 -64 weeks of age. Arbor Acres strain showed highest egg production performance in 35 -39 weeks of age and the lowest egg production performance in 60-64 weeks. There was significant variation in egg production performance between two strains from 25- 59 weeks of age. Cobb-500 showed better result than Arbor Acres strain. Mortality rate of Cobb-500 and Arbor Acres strain was less and there was no significant variation of mortality rate between two strains. In hatchability the performance of two strains Cobb-500 showed better result than Arbor Acres in different weeks of age and there was significant difference found in between of two strains. No significant difference was found in two strains in feed intake per hatching egg between 35-49 weeks of age but difference in other remaining weeks of age and Cobb-500 showed good result than Arbor Acres strain. So farmer could consider these two strains specially Cobb-500 than Arbor Acres for large scale poultry farming as well as small scale poultry farming.

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